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CLINICALLY USEFUL ELECTRONIC HEALTH RECORDS: A VISION FOR THE FUTURE

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Introduction

The promise of an effective, clinically useful electronic health record (EHR) has been discussed for decades. The Institute of Medicine (IOM) Report, "To Err Is Human," discussed the central role of the EHR to reduce errors and promote efficiency while improving quality.[1] Significant electronic system development began in the late 1990s but has continued to fall short in producing a system that meets clinical needs. Many systems are little more than an electronic version of the paper record. Decision support functionality may be imbedded, but current systems fail to be clinically useful because they dramatically slow work flow.

Despite these flaws, the question is no longer *if* but *when* one will adopt an electronic system. In 2004, President Bush, by executive order, set up the Office of the National Coordinator for Health Information Technology (ONCHIT) within Health and Human Services (HHS).[2] The charge was to promote electronic health record adoption and interoperability. Despite all the hype around the office, little progress occurred.

The Current Status of EHR

Discussion over the past two years has again focused on the role of EHR in coordination and efficiency of care. In health care reform, it has been portrayed as a solution for much of what is wrong with an uncoordinated, duplicative health care delivery system. The EHR may be an essential infrastructure component, but current systems are poorly designed. Congress, in the 2009 Stimulus Package, set aside $18 billion in hard money and another $16 billion in savings to promote EHR adoption.[3] That calculates to a $34 billion commitment to electronic health system development. Congress, in the legislation, wanted ONCHIT to develop a set of meaningful use criteria. The criteria developed so far are beyond the capacities of any current system to deliver in a clinically usable way. The goal should be to get as many people as possible to use interoperable EHRs and then progressively improve functionality and usability. Usability is poorly understood by non-clinicians. An EHR may be able to perform a certain function, but can it perform it in a timely, efficient manner?

EHR: Designing a Way to Meet Clinical Needs

The failure to adopt electronic health systems has been placed at the feet of physicians with the claim that they are resistant to change. Nothing is farther from the truth, since physicians change daily with new therapies and procedures that improve medical care. Physicians are not resistant to change, but they need change that improves efficiency within the clinical workflow.

First, systems have to be interoperable to easily and readily exchange data. You can currently exchange laboratory data through HL7 links, but the exchange of a clinical record is another matter. There are solutions, such as clinical document architecture (CDA) or clinical continuity of care records (CCR) that exchange selected amounts of data, but to date these formats do not function in the daily coordination of care and exchange of information that is needed. A less-than-complete record places the physician at risk since they are held accountable in the legal system for all that is known about that patient.

Second, there must be a unique patient identifier (UPI). The identifier helps to track the patient from one medical setting to another. Our society is mobile, and the inability to identify a patient is risky and costly — an issue of quality of care and efficiency. Probabilistic matching is inefficient and a greater invasion of privacy than the UPI. Still, privacy groups have lobbied Congress intensively to block developing a UPI. The Rand Corporation has studied this issue extensively and determined the UPI was necessary to reach the full potential of the EHR.[4] The UPI does not mean ignoring patient privacy issues but instead should provide significant safeguards for patient privacy. Obviously, the patient would have control over the access to their information. The simple basic issues are that patients use various versions of their current name: Mary Jones, Mrs. M. Susan Jones, Mrs. M. Jones, Mrs. M. S. Jones, and Mrs. Robert Jones may all be the same patient. This would require probabilistic matching at every stage of their clinical interaction to ensure that data are attributed to the correct patient. Conversely, a UPI matches patient and information quickly and accurately. It comes down to a patient safety issue.

Third, system development requires that tools are available to support clinical decision-making and promote adherence to clinically recommended therapies. These tools must fit within the clinical workflow and simplify rather than impede that workflow. One of the biggest complaints with current electronic systems is the increased time it takes to see a patient. In the implementation learning phase of an EHR, that is acceptable. However, the long-term use of electronic records has to facilitate care and offer more advantages that improve workflow and quality with the same or less work. This is not cookbook medicine. It is memory tools for the routine patients, because we forget to do important tasks when we see those patients. It's also a fingertip resource-rich tool when we have more complex patients or are using drugs and algorithms that are less familiar. Systems are currently developed without real-world, everyday physician input as to what is needed in the clinic or at the bedside. In response, HL7 has created a clinical/technical committee, Clinical Information Interchange Collaborative (CIIC), to address these specific failings of current development.

Our Experience at Prairie Cardiovascular Consultants

When Prairie Cardiovascular Consultants, Ltd. adopted an EHR in 2000, it was readily apparent that our system, which held great promise, was nothing more than a glorified electronic paper record. The chart was always available, and more than one person could access it at any given time. It did not, however, do anything to promote clinical quality or improve workflow. That was a big disappointment. We therefore decided to develop our own Web-based toolkit that seamlessly interacted with the EHR while providing us with point-of-care decision making and data collection.

The tool concepts were developed with the close collaboration of clinicians and computer programmers. We set out with a rule that no action could require more than three computer clicks to complete. The design was based on the computer abilities of a casual user and not an experienced computer user. There were people within the practice who had little to no experience in using the Internet. In addition, as the products were rolled out for clinical use, a clinical use committee made up of cardiologists, nurses, physician extenders, and secretaries continued to review and advise on system design. Improvements occurred when consensus developed.

We based the computer decision support (CDS) system on ACC/AHA Practice Guidelines because there were, at that time, inconsistencies in clinical guideline recommendations for beta blocker and ACE-inhibitor use. More recently, those issues have been harmonized within the guidelines. We developed computer decision support for stable ischemic heart disease, STEMI, hyperlipidemia, congestive heart failure, anticoagulation, and pre-op surgical evaluation for non-cardiac surgery.

The clinician may use more than one guideline tool, depending on the specific patient in the office. Ideally, the clinician would look at a combined page built specifically for that patient and based on previous or current diagnoses. Those tools are being considered for development now.

The key to clinical decision support is added value to the clinical workflow. It is not a spoon-feeding tool that helps the clinician decide on a diagnosis but a tool that accepts the clinician's diagnosis and helps them deliver best practice care. It allows for exceptions but asks for documentation of those exceptions, which can be easily provided within the clinical workflow. It includes tools for medication adjustment, e-prescribing, and clinical orders. All are performed without leaving the record and without the need for redundant documentation. It shows previous laboratory and procedure results and provides alerts for tests suggested and reminders for future tests. These alerts are based on our practice needs and not some elaborate computer-developed alert system. Pop-ups help to simplify the clinician's work when the clinician activates them; activation occurs based on their individual expertise. Direct links to

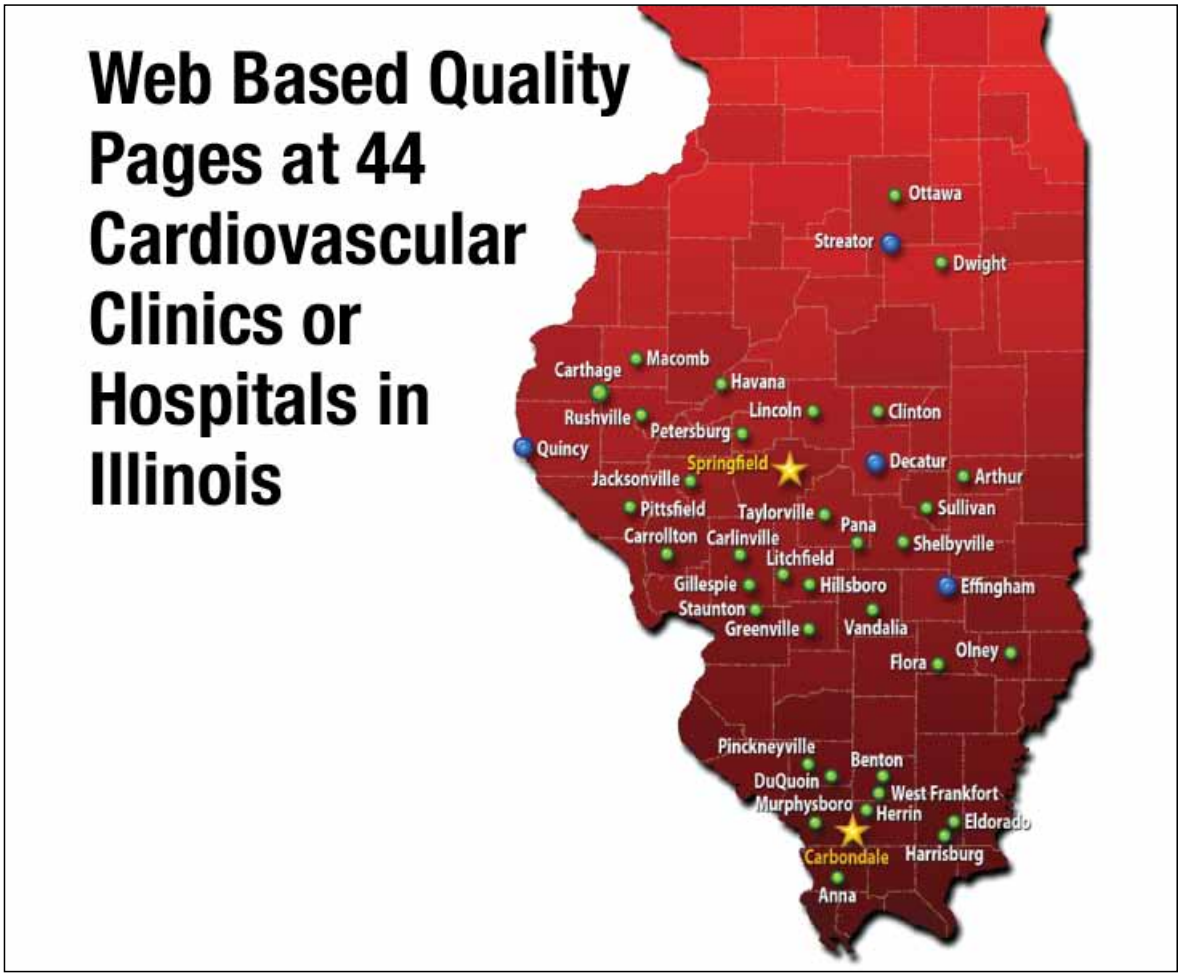

Figure 1. Sites where quality improvement tools can be used via the Web to present the same quality interface every time.

guidelines about specific drugs, guideline algorithms, the entire guideline, and other charts and tables can be instantly accessed, if the clinician wishes. This has been useful because of the different knowledge base of students, residents, RNs, physician extenders, and cardiologists who are seeing the patient — there is no need to guess what the guideline says about a particular strategy because it is instantly accessible.

There are hard stops for drugs, such as aspirin and beta blockers for coronary artery disease. These must be prescribed or an exception listed. There are quality reminders for reaching lipid therapy goals or blood pressure control. Charts can be closed out while waiting for lab studies, but those charts are called to the clinician's attention every time that clinician accesses the system for any patient. This makes it much easier to finish an incomplete record if the clinician is waiting for a laboratory study that was not available during the visit. The clinician knows at the end of the visit if the patient is compliant or not. Failure to be compliant is the fault of the clinician and no one else. The patient has the responsibility to adhere to the prescribed regimen, and the system may be able to develop tools that facilitate adherence.

Another advantage of our Web-based decision support tools is that Prairie sees patients in 44 separate clinical locations (Figure 1), and our physicians can call up the same quality tool at every one of those sites. There is no need to learn a different system based on the hospital or clinic at which you are working. This familiarity alone contributes significantly to patient safety, quality, efficiency, and coordination of care.

The success of these tools is demonstrated in Table 1, which shows the evaluation of 41,462 encounters for coronary artery disease. The chart presents compliance data on the use of aspirin, beta blockers, ACE inhibitors, and statins when only the EHR was used versus the compliance that occurred when using the EHR with the quality improvement tool. Compliance when using the quality tool was 100%

across the board. This means that either the patient was prescribed the medication, or a legitimate documentation was listed for not prescribing it. Finally, this tool illustrates Prairie's success in the Physician Quality Reporting Initiative (PQRI) Medicare Program. Prairie was 100% compliant on 100% of the patients with the diagnosis of coronary artery disease. These tools work.

Designing for the Future

Our goal is to design system tools that are specific for the patient and can be updated quickly as the literature and guidelines change. The translation of science to the bedside takes too long — the process of developing evidence from small studies to randomized controlled trials is part of the issue; the adoption of the science by the clinical guideline writing committee is another. The latter is a slow and painstaking process, although there have been significant improvements made by ACC/AHA guideline writing committees. In the Web-based system described, these quality tools can be updated quickly. For example, the change in the congestive heart failure (CHF) guidelines recommended adding aldosterone antagonists to the regimen of selected CHF patients. This recommendation was implemented in our electronic system the following morning. Pop-ups were added for easy reference about specific cautions and indications in the use of the new therapy. Again, a clinician could choose the pop-up or not, depending on the expertise and understanding of the guideline change. If we had to wait for a vendor to do this, it would probably take 12–18 months before it was part of the decision support tools.

These Web-based tools also provide an opportunity for point-of-care education. A new study that reveals new diagnostic or treatment strategies or confirms current knowledge can be highlighted for the clinician to read when seeing a patient with that exact problem. The clinician may also choose to read a short summary note then or transfer it to a learning portfolio for study at a later time. This facilitates clinical education and a more rapid dissemination of new information at the point of care.

Table 1.

Compliance

Either prescribing or documenting exception

	EMR Only N=17,037		EMR+QI Tool N=24,425	
ASA	13,867	81.4%	24,425	100%
Beta Blocker	12,935	75.9%	24,425	100%
ACE/ARB	11,776	69.1%	24,425	100%
Statin	12,137	72.3%	24,425	100%

The ideal strategy is to move away from vendor-developed computer decision-support tools to a strategy that is Web-based and accessible by subscribers. This supports the development of many niche products from which clinicians can choose to fit their specific clinical needs. This is not unlike the multiple applications developed for the iPhone. As in the iPhone applications, the ingenuity and innovation of the profession is limitless, and we should applaud and support the development of niche products. The vendor role in this strategy would be to develop excellent electronic systems that can readily exchange data with Web-based tools. This is a much more practical strategy for vendors to take than the current slow response system of vendor development. The vendors have no way to keep pace with the changing guidelines of medical specialties or the numerous tools needed to facilitate care at the bedside. They should develop systems that readily store and display the results of the clinical care and simplify extracting data for the personal health record, scientific research, adverse drug reactions, and aggregating data that give us better information on how adherence to process measures improve clinical outcomes. We can develop tools that facilitate the delivery of clinical information to registries, clinical research data collection, and applications that facilitate appropriate use recommendations. Tools would be used for a particular patient only when there is an indication for their use. That is, the tool has to facilitate clinical workflow and automatically collect and report clinical data while improving quality and efficient care.

Data collection and guideline development are ideally performed by professional societies. In the guideline development process, the basic guideline principles are well known before the guideline is finally approved by the various reviewing bodies. During that time, the clinicians and computer programmers can rewrite and adjust the quality tools that are needed for implementation.

Summary

While the tools discussed so far apply to Class I Guideline Recommendations, there is a need to go further. Developing tools for Class IIa, IIb, and III

recommendations are just a few steps away, and this needs to be done. Currently, most clinicians are applying Class IIa and IIb guidelines from memory rather than from specific guideline references. As we have seen in many areas, memory is good but falls far short of the 100% compliance for which we strive.

We have some evidence documenting how following clinical guidelines leads to improved outcomes. Garg and others reviewed the literature and showed that various CDS improved process performance, but the link to improved outcomes was poorly studied and inconsistent.[5] The CRUSADE trial showed that process measure compliance in general did lead to better outcomes with decreased morbidity and mortality.[6]

The potential value of an EHR in clinical medicine is essentially unlimited but currently suffers from a lack of tools that are usable at the point of care. Failure to understand the importance of clinical usefulness within the clinical workflow is a major fault of nearly all systems that are available. The future is dependent on EHR vendors allowing the ready exchange of data elements that can run on a series of Web-based tools to improve quality and efficiency of care. The number of data elements is actually relatively small. The opportunity to better understand the effects of treatment strategies on outcomes in real-world settings is obtainable, but it requires interoperability and removal of the proprietary roadblocks that currently prevent it. Validation that what we are doing actually improves outcomes is an important gap in our current knowledge base. Properly designed information technology can help close that gap.

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